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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte PAUL G. HICKS

Appeal 2015-003790
Application 12/615,073
Technology Center 3700

Before JOHN C. KERINS, JAMES P. CALVE, and SCOTT A. DANIELS, *Administrative Patent Judges*.

CALVE, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Appellant appeals under 35 U.S.C. § 134 from the final rejection of claims 1–23. Appeal Br. 4. Claims 24 and 25 are withdrawn. *Id.* We have jurisdiction under 35 U.S.C. § 6(b).

We REVERSE.

CLAIMED SUBJECT MATTER

Claims 1 and 17 are independent. Claim 1 is reproduced below.

> 1. A fuel injector apparatus, comprising:
>
> an injector body having a bore therethrough, the bore defining a fuel manifold;
>
> a variable-area injector arrangement having a pintle with a conical head and a pintle spring operatively connected to the injector body in such a manner that the spring urges the conical head to seal against a variable-area exit orifice located at one end of the body to thereby prevent the passage of pressurized fuel through the variable-area exit orifice, and such that application of pressurized fuel within the injector body causes the pintle to move such that the conical head of the pintle is moved out of contact with the variable-area exit orifice of the body as a function of the pressure of the pressurized fuel in the injector body, to thereby provide a corresponding variable area for passage of the pressurized fuel through the variable-area exit orifice about the conical head of the pintle; and
>
> a fuel swirler positioned within the manifold and configured to create a swirling action in the flow of pressurized fuel within the fuel manifold, wherein the fuel manifold is upstream of the variable-area exit orifice.

REJECTIONS

Claims 1, 2, 4–6, 10, 11, and 14–20 are rejected under 35 U.S.C. § 102(b) as anticipated by Xu (US 6,042,028, iss. Mar. 28, 2000).

Claim 3 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Xu and Howell (US 5,930,999, iss. Aug. 3, 1999).

Claims 7, 12, 13, 21, and 23 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Xu and Young (US 5,058,808, iss. Oct. 22, 1991).

Claim 8 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Xu, Young, and Bailey (US 3,444,886, iss. May 20, 1969).

Claims 9 and 22 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Xu and Tilton (US 5,713,327, iss. Feb. 3, 1998).

ANALYSIS

Claims 1, 2, 4–6, 10, 11, and 14–20 as anticipated by Xu

The Examiner found that Xu teaches a fuel injector, as recited in independent claims 1 and 17, including pintle 26 with conical head 32, and variable-area exit orifice 36 to prevent passage of pressurized fuel "such that application of pressurized fuel within the injector body causes the pintle to move such that the conical head of the pintle is moved out of contact with the variable-area exit orifice of the body as a function of the pressure of the pressurized fuel in the injector body." Final Act. 2. The Examiner found that Xu is capable of performing this claimed function because Xu has all of the claimed structure of the conical head, exit orifice, and pressurized fuel. *Id.* at 6–7. The Examiner reasoned that pressurized fuel moving through the injector valve of Xu inherently acts on this structure at the same time that the solenoid actuator acts on the injector valve so that the pintle and its conical head are moved out of contact with the exit orifice as a function of both the pressurized fuel and the solenoid actuator. Ans. 3.

Appellant argues that Xu is not capable of performing the claimed function of using the pressure of pressurized fuel to cause the conical head of the pintle to move out of contact with the variable-area exit orifice of the body because it uses a magnetic actuator to open and close the pintle and thus has a different structure than Xu. *See* Appeal Br. 11–14. Appellant also argues that Xu does not inherently disclose the claimed function but describes a different function than is claimed. Reply Br. 6–8. As a result, Appellant argues that fluid pressure will not open Xu's valve. *Id.* at 9.

The Examiner did not have a sound basis to find that Xu inherently performs the claimed function of applying pressurized fluid to cause the pintle and its conical head to move out of contact with the variable-area exit of the body. "Inevitability is at the heart of inherency; 'that a certain thing may result from a given set of circumstances is not sufficient.'" *Howmedica Osteonics Corp. v. Zimmer, Inc.*, 640 Fed. Appx. 951, 957 (Fed. Cir. 2016) (non-precedential) (quoting *In re Robertson*, 169 F.3d 743, 745 (Fed. Cir. 1999)). Features of an apparatus may be recited structurally or functionally. *In re Schreiber*, 128 F.3d 1473, 1478 (Fed. Cir. 1997).

The claimed fuel injector uses pintle spring 124 to seal conical head 118 of pintle 114 against variable-area exit orifice 134 and fuel pressure in the injector to move pintle 114 and its conical head 118 out of contact with variable-area exit orifice 134. Spec. ¶ 26, Fig. 2.

Xu uses pintle spring 38 to urge valve head 32 against valve seat 36, but Xu uses magnetic actuator/solenoid 42 to open pintle valve 26 and assist spring 38 in quickly closing the valve at the end of an injection period. Xu, 3:38–44; Appeal Br. 12–14. Actuator 42 opens the valve a predetermined amount to create a gap of about 30 microns between valve seat 36 and valve head 32. Xu, 4:26–33. When the valve is opened fully to a constant gap of about 30 microns, the pressure drop across the nozzle forces a thin sheet of fuel out of the nozzle as a hollow cone spray. *Id.* at 2:21–26.

The Examiner's finding that Xu's pintle valve is opened even partially as a function of the pressurized fuel is not supported by a preponderance of evidence. Final Act. 2–3, 6–7; Ans. 3–4. The Examiner has not identified a disclosure in Xu that the nozzle opens as a function, even in part, of the fuel pressure. *See* Final Act. 2, 6–7; Ans. 3.

Xu uses solenoid actuator 42 to open the valve by a predetermined amount to control the size and pattern of the fuel droplets in conjunction with the pressure drop through the nozzle. *See* Xu, 2:9–44, 4:22–33.

> High pressure fuel at 10 MPa is delivered to the injector and passes through internal passages with a negligible pressure drop until reaching the nozzle assembly. . . . *When the valve is fully opened*, about half of the fuel pressure, 5 MPa, is consumed in passing through the swirler holes and developing the swirl motion. The remaining 5 MPa pressure drop occurs at the sealing point of the valve head against the valve seat. *When the valve is opened fully to a constant seat gap of about 30 microns,* the pressure drop forces a very thin liquid sheet of fuel out of the nozzle assembly as a hollow cone which quickly develops, after injection to the combustion chamber, into a hollow cone spray of small fuel droplets injected with a swirl that helps to control spray penetration.

Id. at 2:9–26 (emphasis added). This passage indicates that half of the fuel pressure drops across swirler 24. The other half is used in passing through the nozzle *when the valve is fully opened.* Xu does not disclose that the fuel pressure plays any role in opening the valve. The force of spring 38 by itself is sufficient to close the valve against fluid pressure, but solenoid actuator 42 helps it to close faster. *See id.* at 3:38–44. The further statement in Xu, that *when the valve is opened* by magnetic solenoid 42, the pressure drop across the valve head forces a thin liquid sheet of fuel out of the nozzle provides no suggestion that fuel pressure helps to open the valve. *Id.* at 2:21–24.

For the foregoing reasons, the Examiner did not have a sound basis for finding that Xu has structure similar to the claimed fuel injector, or that Xu's injector is capable of performing the function recited in claims 1 and 17. Thus, we do not sustain the rejection of independent claims 1 and 17 or their dependent claims 2, 4–6, 10, 11, 14–16, and 18–20.

Dependent claims 3, 7–9, 12, 13, and 21–23

The Examiner rejected dependent claims 3, 7–9, 12, 13, and 21–23 as unpatentable over Xu in combination with one or more of Howell, Young, Bailey, and Tilton. *See* Final Act. 4–6. The Examiner relied on Howell, Young, Bailey, and Tilton to teach features of these dependent claims and not to overcome deficiencies of Xu noted above as to independent claims 1 and 17. *See id.*; Appeal Br. 15–17. Thus, we do not sustain the rejection of these claims.

DECISION

We REVERSE the rejections of claims 1–23.

REVERSED